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EXAMINER	
CHUO, TONY SHENG HSIANG	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/686,896
Filing Date: October 15, 2003
Appellant(s): ARTHUR ET AL.

Steven L. Nichols
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/23/08 appealing from the Office action mailed 12/31/07.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

Claims 39-60 have been canceled.

This appeal involves claims 1-7, 9-24, 29-38, and 61-65.

Claims 8 and 25-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

2002/0076598	BOSTAPH et al	6-2002
2003/0022051	HALUZAK	1-2003
6,503,651	NGUYEN	1-2003
5,773,160	WILKINSON et al	6-1998
JP 08-213043	TAKAYANAGI	8-1996
2003/0235745	MOOK et al	12-2003

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-5, 7, 11-14, 61, and 62 are rejected under 35 U.S.C. 102(b) as being anticipated by Bostaph et al (US 2002/0076598).

Regarding claims 1, 61, and 62, the Bostaph reference discloses a fuel cell system comprising: a substrate “27” & “14”; an array of fuel cells “10”, each having an anode “18”, a cathode “22”, and an electrolyte “20” disposed on the substrate; current collectors “28” electrically coupled to the fuel cell array; a fuel flow channel “30” defined in first anode side of the substrate; and a cathode air flow channel “29” defined in a second and opposite cathode side of the substrate (See paragraphs [0018],[0022],[0024],[0027] and Figure 1). Examiner’s note: Claim 61 appears to invoke 35 USC 112, sixth paragraph. The substrate “27” & “14” is construed as an equivalent structure for supporting an array of fuel cells. The cathode air flow channel

"29" is construed as an equivalent structure for conveying cathode air across the array of fuel cells. The fuel flow channel "30" is construed as an equivalent structure for conveying fuel across the array of fuel cells. The current collectors "28" are construed as an equivalent structure for removing electricity from the array of fuel cells.

Regarding claims 2 and 3, it also discloses a fuel inlet "30" and a fuel outlet "52" that are defined in the substrate and are in fluid communication with the fuel flow channel (See paragraphs [0019],[0020] and Figure 1).

Regarding claims 4 and 5, it also discloses a cathode air inlet "29" and an excess cathode air outlet "28" that are defined in the substrate and are in fluid communication with the cathode air flow channel (See Figure 1).

Regarding claim 7, it also discloses an array of fuel cells "12" that are disposed with the fuel flow channel and the cathode air flow channel (See Figure 1).

Regarding claim 11, it also discloses current collectors "28" that are located on the cathode side of the substrate, wherein the cathode side serves as a circuit side of the substrate (See paragraph [0024]).

Regarding claim 12, it also discloses an electrolyte "20" that seals non-active portions of the substrate (See Figure 1).

Regarding claims 13 and 14, it also discloses flow modification features "66" associated with the fuel flow channel "72", wherein the flow modification features are configured to distribute a flow of fuel emerging from an inlet across the width of the fuel

flow channel, wherein the flow modification features comprise a plurality of baffles (See Figure 2).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Wilkinson et al (US 5773160). The Bostaph reference is applied to claims 1, 2, and 4 for reasons stated above.

However, Bostaph et al does not expressly teach a fuel inlet and outlet in the first and second opposing corner portions and an air inlet and outlet in third and fourth opposing corner portions of the substrate. The Wilkinson reference teaches a flow field plate that could also be a substrate for fuel cells that is rectilinear and comprises a fuel inlet “244” and fuel outlet “246” in the first and second opposing corner portions and an air inlet “240” and air outlet “242” in third and fourth opposing corner portions of the substrate (See Figure 6A).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include a fuel inlet and outlet in the first and second opposing corner portions and an air inlet and outlet in third and fourth opposing corner portions of the substrate so that the overall size of the fuel cell can be reduced by centrally locating the inlets and outlets on the same substrate.

Claims 9, 10, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Takayanagi (JP 08-213043). The Bostaph reference is applied to claims 1 and 61 for reasons stated above.

However, Bostaph et al does not expressly teach fuel flow channels along a first axis and cathode air flow channels along a second axis disposed at an angle that is

substantially normal to the first axis. The Takayanagi reference teaches a layered fuel cell with fuel flow channels "45" that are perpendicular to the cathode air flow channels "44" (See Drawing 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include fuel flow channels that are perpendicular to the cathode air flow channels so that the fuel gas and air gas can be more efficiently delivered to the fuel cells.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598). The Bostaph reference is applied to claim 1 for reasons stated above.

However, Bostaph et al does not expressly teach conductors that are located on the anode side of the substrate, wherein the anode side serves as a circuit side of the fuel cell. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include conductors that are located on the anode side of the substrate, wherein the anode side serves as a circuit side of the fuel cell because rearrangement of parts was held to have been obvious (In re Japikse 86 USPQ 70 (CCPA 1950)).

Claims 16, 32-34, 36, 63, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051).

The Bostaph reference discloses a fuel cell system comprising: a substrate "27" & "14"; an array of fuel cells "10", each having an anode "18", a cathode "22", and an

electrolyte “20” disposed on the substrate; current collectors “28” electrically coupled to the fuel cell array; a fuel flow channel “30” defined in anode side of the substrate; and a cathode air flow channel “29” defined in an opposite cathode side of the substrate (See paragraphs [0018],[0022],[0024],[0027] and Figure 1). It also discloses a fuel inlet “30” and a fuel outlet “52” that are defined in the substrate and are in fluid communication with the fuel flow channel (See paragraphs [0019],[0020] and Figure 1).

It also discloses a cathode air inlet “29” and an excess cathode air outlet “28” that are defined in the substrate and are in fluid communication with the cathode air flow channel (See Figure 1). It also discloses current collectors “28” that are located on the cathode side of the substrate, wherein the cathode side serves as a circuit side of the substrate (See paragraph [0024]). It also discloses an electrolyte “20” that seals non-active portions of the substrate (See Figure 1).

However, Bostaph et al does not expressly teach a plurality of fuel cell layers each including an array of fuel cells, wherein the fuel cell layers are alternatingly stacked; a plurality of supporting means, wherein a plurality of supporting means comprises means for delivering and removing fuel and cathode air to and from the system; seals disposed around the inlets, exhaust and outlet and around the perimeter of the fuel cell array; and fuel cell layers that are coupled so as to form a parallel electrical circuit. The Haluzak reference discloses a plurality of fuel cell layers “40” each including an array of fuel cells, wherein the fuel cell layers are alternatingly stacked (See Figure 5). It also discloses inlets, outlets, and perimeter of the array that are

sealed with epoxy (See paragraph [0037]). It also discloses fuel cell layers that are coupled to form a parallel electrical circuit.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph fuel cell to include a plurality of fuel cell layers each including an array of fuel cells, wherein the fuel cell layers are alternatingly stacked; a plurality of supporting means, wherein a plurality of supporting means comprises means for delivering and removing fuel and cathode air to and from the system; seals disposed around the inlets, exhaust and outlet and around the perimeter of the fuel cell array; and fuel cell layers that are coupled so as to form a parallel electrical circuit in order to maximize the energy density of the fuel cell system stacking fuel cell layers.

Claims 17-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16, above, and further in view of Takayanagi (JP 08-213043).

However, Bostaph et al as modified by Haluzak does not expressly teach fuel cell layers that are coupled such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer thereby forming a fuel flow plenum; fuel cell layers that are coupled such that a fuel cell layer shares a cathode air flow channel with a second adjacent fuel cell layer thereby forming a cathode air flow plenum; a plurality of fuel inlets that form a fuel inlet plenum and a plurality of exhausts that form a fuel exhaust plenum; fuel inlet plenum and exhaust plenum that are in fluid communication with the fuel flow plenum; a plurality of cathode air inlets that form a cathode air inlet plenum and

a plurality of excess cathode air outlets that form an excess cathode air plenum; cathode air inlet plenum and excess cathode air outlet plenum that are in fluid communication with the cathode air flow plenums. The Takayanagi reference discloses flow channels that form fuel inlet, fuel outlet, air inlet, and air outlet manifolds (See Figure 3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell system to include fuel cell layers that are coupled such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer thereby forming a fuel flow plenum; fuel cell layers that are coupled such that a fuel cell layer shares a cathode air flow channel with a second adjacent fuel cell layer thereby forming a cathode air flow plenum; a plurality of fuel inlets that form a fuel inlet plenum and a plurality of exhausts that form a fuel exhaust plenum; fuel inlet plenum and exhaust plenum that are in fluid communication with the fuel flow plenum; a plurality of cathode air inlets that form a cathode air inlet plenum and a plurality of excess cathode air outlets that form an excess cathode air plenum; cathode air inlet plenum and excess cathode air outlet plenum that are in fluid communication with the cathode air flow plenums in order to deliver fuel and air to the fuel cells more efficiently.

Claims 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16 above, and further in view of Nguyen (US 6503651).

However, Bostaph et al as modified by Haluzak does not expressly teach fuel flow channels or air flow channels comprising ports that can be opened or closed to selectively activate or deactivate each individual layer of the plurality of layers. The Nguyen reference teaches a fuel cell stack comprising ports “353”, “354”, “355” with valves “340” that can be opened or closed to selectively activate or deactivate each individual fuel cell in the fuel cell stack (See Figure 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell system to include fuel flow channels or air flow channels comprising ports that can be opened or closed to selectively activate or deactivate each individual layer of the plurality of layers in order to improve the nonuniformity in flow resistance among the cells in the stack that leads to nonuniform cell-to-cell performance and non-optimal stack performance.

Claims 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claim 16 above, and further in view of Takayanagi (JP 08-213043).

However, Bostaph et al as modified by Haluzak does not expressly teach fuel flow channels along a first axis and cathode air flow channels along a second axis disposed at an angle that is substantially normal to the first axis. The Takayanagi reference teaches a layered fuel cell with fuel flow channels “45” that are perpendicular to the cathode air flow channels “44” (See Drawing 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell to include fuel flow

channels that are perpendicular to the cathode air flow channels so that the fuel gas and air gas can be more efficiently delivered to the fuel cells.

Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) as applied to claims 16 and 34 above, and further in view of Mook et al (US 2003/0235745).

However, Bostaph as modified by Haluzak does not expressly teach seals that comprise an electrically conductive material. The Mook reference does teach a seal that is electrically conductive (See Abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak fuel cell to include seals that are electrically conductive in order to allow the flow of electric current between the anode and the cell manifold.

Claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bostaph et al (US 2002/0076598) in view of Haluzak (2003/0022051) and Takayanagi (JP 08-213043) as applied to claim 24 above, and further in view of Nguyen (US 6503651).

However, Bostaph as modified by Haluzak and Takayanagi does not expressly teach fuel and cathode air manifolds that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the inlet plenum, and exhaust manifold that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the exhaust plenum. The Nguyen reference teaches a fuel cell stack comprising ports “353”, “354”, “355”, ”356”, ”357”,”358” with valves “340” that can be opened or closed to

selectively activate or deactivate each individual fuel cell in the fuel cell stack (See Figure 6).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Bostaph/Haluzak/Takayanagi fuel cell system to include fuel and cathode air manifolds that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the inlet plenum and exhaust manifold that have a plurality of selectively opened inlet ports coupled to flow plenums disposed with the exhaust plenum in order to improve the nonuniformity in flow resistance among the cells in the stack that leads to nonuniform cell-to-cell performance and non-optimal stack performance.

(10) Response to Argument

The appellant argues that one of skill in the art would clearly understand that "a substrate" refers to a single, two-sided substrate with the two, first and second, sides being opposite each other. The appellant further states that, in contrast, Bostaph does not teach or suggest the claimed fuel cell layer or system in which a fuel flow channel is defined in one side of a substrate and a cathode air flow channel is defined in a second, opposite side of the same substrate.

Firstly, this argument is not commensurate with the scope of the claims because there are no limitations in the claims that require a single, two sided substrate.

Secondly, claims are given the broadest reasonable interpretation. Therefore, it is reasonable to conceive that a substrate can be formed from two separate components.

Thirdly, the base portion “14” and the cap portion “27” taught by Bostaph et al, are necessarily sealed to the membrane electrode assemblies “16” in order to prevent the cathode air and fuel from mixing. Since the base portion and cap portion are sealed together during the assembly of the fuel cell device, the final component is construed as a single, integral substrate.

Fourthly, Bostaph et al does teach a fuel flow channel "30" defined in a first side of the substrate and a cathode air flow channel “29” defined in a second, opposite side of the substrate as shown in Figure 1.

The appellant also argues that element “28” of Bostaph is not an excess cathode air outlet, but rather is a current collector. The appellant further states that Bostaph clearly fails to teach or suggest all the subject matter of claim 4. Although reference number 28 is labeled as a current collector, the examiner is relying on the space/cavity that is shown by reference number 28 in Figure 1. This space referred to by reference number 28 is construed as a cathode air outlet because the cathode air enters from the cathode air inlet “29” of the cap portion "27" and exits to the cathode air outlet “28” of the cap portion “27”.

Regarding claim 12, the appellant argues that it is unclear from Fig. 1 if the electrolyte (20) even makes contact with either substrate, let alone seal non-active portions of the substrate. Although Figure 1 does not show the electrolyte “20” being in contact with the substrate “27” & “14”, it is well known in the art that the electrolyte layer is necessarily sealed to the top portion and bottom portion of the substrate in order to prevent the cathode air from mixing with the fuel. Since the electrolyte layer has an

area greater than the area of the anode “18” and the cathode “22”, one skilled in the art would know that the electrolyte layer seals the non-active portions of the substrate which would be the area of the substrate outside the area of the anode and cathode in order to maximize the active area of the anode and cathode.

Regarding claim 13, the appellant argues that there is no teaching or suggestion of the claimed flow modification features “being configured to distribute a flow of fuel or air emerging from an inlet across a width of said fuel flow channel or said air flow channel, respectively." Since the layer "66", shown in Figure 2, performs the same function to distribute a flow of fuel emerging from an inlet across a width of the fuel flow channel “72”, it reads on claim 13.

Regarding claim 16, the appellant argues that there is no cathode air flow channel that is similarily defined in an opposite or cathode side of the substrate of the Haluzak system. The Haluzak reference is relied upon for teaching the concept of a plurality of fuel cell layers each including an array of fuel cells, wherein the fuel cell layers are alternatingly stacked. Since Bostaph already teaches fuel flow channel defined in an anode side of the substrate and a cathode air flow channel defined in an opposite cathode side of the substrate, then the stacking of the fuel cell layers alternatingly would be within the level of one skilled in the art as taught by the Haluzak reference.

Regarding claim 29, the appellant argues that Nguyen does not teach or suggest the claimed ports that selectively activate or deactivate individual fuel cell layers. Although Nguyen does not expressly teach the function of selectively activating or

deactivating each individual layer of the plurality of layers, the valves that are taught by Nguyen are at least capable of selectively activating or deactivating each individual layer. By selectively opening a valve of an individual layer, the port in the flow channel is essentially opened to activate the individual layer. By selectively closing a valve of an individual layer, the port in the flow channel is essentially closed to deactivate the individual layer.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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